Technical Information in Support of the Department of the Interior's Request for a Rule to Restore and Protect Air Quality Related Values

by

National Park Service Air Resources Division and
U.S. Fish and Wildlife Service Air Quality Branch

December 2000

1. Introduction

This information is submitted on behalf of the National Park Service (NPS) and U.S. Fish and Wildlife Service (FWS) in response to the U.S. Environmental Protection Agency's (EPA) August 9, 2000, notice soliciting public comment on rulemaking requests filed by the U.S. Department of the Interior (DOI) and several states. 65 Fed. Reg. 48699-48701. On July 19, 2000, the DOI requested that EPA initiate a rulemaking proceeding to enhance air quality in national parks and wilderness areas in order to protect air quality related values (AQRVs) that are being adversely affected by air pollution. The NPS and FWS have documented that AQRVs are being adversely affected by air pollution at numerous national parks and wilderness areas (e.g., acidification of streams, surface waters, and/or soils at Shenandoah, Sequoia, and Great Smoky Mountains National Parks (NPs); eutrophication of coastal waters in Chassahowitzka National Wildlife Refuge; visibility impairment in all parks and wildernesses; and foliar injury from ozone at a number of parks and wildernesses, including Great Smoky Mountains, Shenandoah, Sequoia, and Yosemite NPs, and Cape Romain and Mingo National Wildlife Refuges). In other areas, we strongly suspect that resources are or may soon be damaged by air pollution (e.g., increasing nitrate deposition at Rocky Mountain NP, where episodic acidification already occurs nearby; possible symptoms of ozone injury detected at some parks in the Colorado Plateau region with increasing ozone levels at other nearby park units).

This technical support document synthesizes available scientific information regarding the air pollution effects in these units. This material supplements information we provided to EPA on July 19, 2000, and the more generally available information on the adverse effects of air pollution referenced in EPA's August 9 notice.

This document addresses three primary effects of air pollution on natural resources: (1) terrestrial effects of ozone; (2) aquatic and terrestrial effects of wet and dry pollutant deposition; and (3) visibility impairment. Major conclusions and recommendations are summarized briefly below, followed by a more detailed discussion of available information. Most of the reports and papers referenced are peer-reviewed publications available in the open literature. Copies of other reports cited are either attached to this technical support document or will be provided to EPA shortly.

Overview of Ozone Impacts:

Ozone is one of the most phytotoxic air pollutants. It causes considerable damage to vegetation throughout the world, and many native plants in natural ecosystems are sensitive to ozone. Ozone-induced foliar injury has been documented on a number of tree species throughout much of the eastern United States and in the Sierra Nevada Mountains of California. It is difficult to make definitive conclusions about the ozone sensitivity of particular species because of the different ozone exposure regimes or interactions with weather. The National Park Service (NPS) and U.S. Fish and Wildlife Service (FWS) have conducted ozone injury surveys in a limited number of areas. The results indicate current ozone concentrations in a number of NPS and FWS areas are high enough to cause foliar injury and/or growth loss in sensitive species. In addition, fumigation and other field studies at Great Smoky Mountains NP showed that in addition to foliar injury, ozone concentrations typical of higher elevations in the park are sufficient to cause biomass loss in sensitive species. Moreover, based on trend analyses, it appears that ozone concentrations are increasing in many areas where ozone is already injuring vegetation.

In EPA's July 18, 1997, *Federal Register* notice regarding the ozone NAAQS, it recognized that the 8-hour primary standard of 80 ppb, while more protective than the previous 1-hour standard, might not protect vegetation in Class I air quality areas. There is still some debate among ozone effects experts regarding the correct form of a potential secondary standard, however, it appears from the literature cited below that all of the experts favor a standard based on cumulative concentration, and most recommend that the exposure be accumulated over both a 24-hour period and the growing season. Cumulative ozone statistics, such as SUM06 and W126 (the sum of hourly average ozone concentrations using a sigmoidal weighting function), best represent foliar injury observations.

An analysis of ozone monitoring data in several parks and wilderness areas shows that cumulative ozone exposure in excess of levels known to injure vegetation occurs in areas where the 8-hour standard is not likely to be exceeded. Therefore, we urge EPA to develop a secondary ozone standard that is truly protective of natural vegetation. Even if EPA promulgates a secondary ozone standard that is more appropriate and protective than the current one, it is possible that the standard might not be sufficient to protect certain sensitive species. In those cases, the recommended AQRV protection regulation would provide Federal Land Managers an avenue for protecting areas against ozone-related effects on vegetation.

Overview of Acid Deposition Impacts:

Deposition of nitrogen and sulfur compounds are of particular concern to the NPS and FWS because of their effects on freshwater lakes, streams, ponds, the soils and watersheds surrounding these surface waters, estuarine ecosystems, and forest and alpine ecosystems. Such effects include changes in water chemistry that affect algae, fish, submerged vegetation, and amphibian and aquatic invertebrate communities, and changes in soil chemistry that affect growth, species composition and winter hardiness of plants and trees. These changes can result in higher food chain impacts.

The NPS has observed chronic and episodic acidification of streams in both Shenandoah and Great Smoky Mountains NPs. At Shenandoah NP, fish in sensitive aquatic ecosystems are being

affected at the community level (reduced species richness in streams), population level (mortality of brook trout), and organism level (reduced growth in black-nosed dace). At Great Smoky Mountains NP, large amounts of nitrogen are being exported into park streams during the growing season, stream pH is declining throughout the park, and forest ecosystems are experiencing chemical imbalances that contribute to tree stress. Modeling indicates that substantial reductions in nitrogen and sulfur deposition will be needed to prevent increasing acidification and improve currently degraded aquatic and terrestrial ecosystems in these parks. Scientists have also documented nitrogen saturation in Rocky Mountain NP and episodic acidification in areas near the park. Phytoplankton blooms, indicating system sensitivity to nitrogen inputs, have occurred at Chassahowitzka National Wildlife Refuge. Other coastal areas managed by the FWS may already be experiencing eutrophication due to excess nitrogen, including Brigantine Wilderness (New Jersey) and Swanquarter Wilderness (North Carolina).

None of these parks or wilderness areas are violating existing NAAQS for sulfur dioxide or nitrogen oxides. It is not clear whether all of these areas would also be in compliance with a new fine particle NAAQS because of uncertainty regarding the method that will be used to determine compliance. In any event, environmental performance measures should be linked directly to indicators of ecological health, like nitrogen and sulfur deposition. Sufficient information appears to be available to begin the process of setting "target loads" for deposition in several national parks around the country. Once established, these loading levels could drive air pollution control and prevention programs and be used as a measure of their success.

Overview of Visibility Impacts:

The causes and effects of visibility impairment are very well-established. Visibility degradation occurs in parks and wilderness areas all over the country, resulting in diminished visitor enjoyment of natural scenic beauty. Sulfate and carbon species are the largest contributors to visibility reductions at all non-urban monitoring sites operated by the NPS and FWS. Visibility trends vary across the country and reflect the relative effectiveness of current air quality control programs when combined with emissions growth associated with increasing population and economic conditions. Based on analyses of areas that contribute to poor visibility in certain parks and wilderness areas, it is apparent that broad-scale emission reduction programs will be needed to restore natural visibility conditions but targeted actions may be appropriate to address impacts from some key source regions or to alleviate episodic impacts.

EPA's visibility protection regulations provide appropriate mechanisms for addressing visibility problems in national parks and wilderness areas. New programs to be developed in response to the regional haze regulation will compliment ongoing opportunities for Federal Land Managers to identify specific sources or small groups of sources that contribute to significant visibility impairment in Class I areas and seek regulatory action from States or EPA. Emission reductions that are expected to be required to achieve reasonable progress toward visibility goals will benefit other air quality related values by reducing pollutants that contribute to harmful ozone levels and acid deposition; however, terrestrial and aquatic ecosystems that are currently experiencing significant adverse effects from air pollution may require different approaches or more expeditious attention.